复旦大学物理系 Colloquium

Time: 14:00, Tuesday, 2023.6.13

Location: C108, Jiangwan Physics Building（线下报告）

Newborn super star clusters at Cosmic Noon under gravitational lenses

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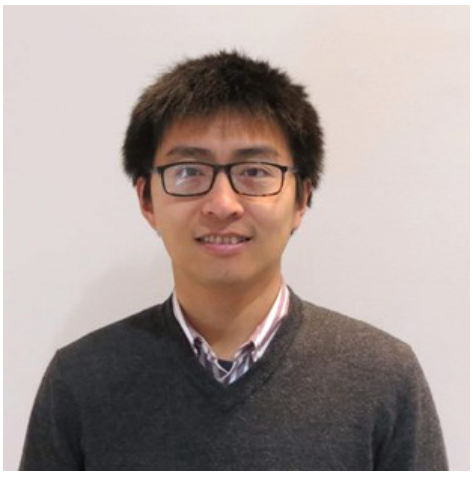
Abstract: Super star clusters (SSCs) exemplify an extreme mode of star formation in the Universe. When an SSC is born, molecular gas weighing millions of our Sun or more converts into stars in a few million years within a volume of just several light years across. Such a system likely stays bound over billions of years and becomes a globular cluster. Naively, all cluster member stars form from the same natal cloud and hence must have uniform chemical composition. Therefore, the discovery of second-generation (2G) stars with abnormal element abundances in most globular clusters has been a big surprise. It hints at additional physical processes that make new stars out of gas mixed with hydrogen-burning-processed material expelled by massive stars that are already born. The origin of 2G cluster stars is an intriguing puzzle, but unfortunately direct observation of newborn SSCs is scarce in the local Universe, which limits our understanding of SSC evolution in the first 10 million years. I will present our new study of very young SSC candidates in a distant galaxy when the Universe was still young (z~2), for which good data is available owing to gravitational lensing. Combining photometric and spectral modeling, we find that the SSC candidates host dense gas clouds heavily enriched with nitrogen, which suggests that nucleo-synthesized ejecta from massive stars is efficiently retained in the cluster’s gravitational potential. These results are important clues to the sought physical processes relating to the formation of 2G stars that probably occur in the early evolution of a typical SSC. Our study calls for more detailed observation of newborn SSCs, as well as a better theoretical understanding of the interplay between gas dynamics, radiation and gravity in dense star-forming environments.



Biography: Liang Dai is a junior professor at University of California, Berkeley (UCB) and an Alfred P. Sloan Research Fellow. Prior to joining the faculty of UCB, he was a postdoctoral fellow and an NASA Einstein Fellow at the Institute for Advanced Study. He accomplished a PhD dissertation on theoretical cosmology at Johns Hopkins University. Before that, he earned a B.Sc. degree in physics at Peking University. His current research interests include strong gravitational lensing, cosmology, and astrophysical gravitational waves.